

CLAIMS

What is claimed is:

1. An apparatus for characterizing a void in a first scan target associated
5 with a sample, the sample having a first surface and a second surface, the apparatus
comprising:
an x-ray emission inducer configured to scan a first scan target, the x-ray
emission inducer causing the first scan target to emit x-rays from the first surface;
an x-ray emission detection system configured to obtain a measurement of the
10 x-rays emitted from the first surface of the sample, wherein the x-ray measurement
is compared to a control measurement to characterize a void in the first scan target.
2. The apparatus of claim 1, further comprising a stage configured to
secure the sample, wherein the stage is configured to position the sample relative to the
x-ray emission inducer.
- 15 3. The apparatus of claim 2, wherein positioning the sample comprises
rotating the sample.
4. The apparatus of claim 2, wherein the first scan target comprises a via.
5. The apparatus of claim 4, wherein the sample is a wafer comprising a
plurality of integrated circuits.
- 20 6. The apparatus of claim 1, wherein the x-ray emission detection system is
configured to detect x-rays with a first emission energy corresponding to a first
material.
7. The apparatus of claim 6, wherein the first material comprises Cu.
8. The apparatus of claim 7, wherein the x-ray emission detection system is
25 further configured to detect x-rays with a second emission energy corresponding to a
second material.
9. The apparatus of claim 8, wherein the second material comprises Ta.
10. The apparatus of claim 9, wherein the control measurement is obtained
by scanning an adjacent scan target.
- 30 11. A system for characterizing voids associated with a sample, the sample
having a first surface and a second surface, the system comprising:
memory;

a processor coupled with memory, the processor configured to identify a first measurement of induced x-ray emissions characteristic of a first material at a first scan target, identify a control measurement, and provide the first measurement and the control measurement for comparison to thereby obtain information for characterizing a void associated with the first scan target in the sample.

12. The system of claim 11, wherein the first material has low resistivity.

13. The system of claim 12, wherein the first material is copper.

14. The system of claim 11, wherein the sample is a wafer comprising a plurality of integrated circuits.

15. The system of claim 11, further comprising identifying a second measurement of x-ray emissions characteristic of a second material.

16. The system of claim 11, wherein the second material is a barrier material.

17. The system of claim 16, wherein the second material is Ta.

18. The system of claim 11, wherein characterizing voids associated with the sample comprises determining the size and location of a void.

19. The system of claim 11, wherein the control measurement is obtained by scanning an adjacent scan target.

20. The system of claim 19, wherein the scan target is a via.

21. The system of claim 20, wherein the adjacent scan target is an adjacent via.

22. The system of claim 21, wherein the control measurement is obtained by scanning adjacent vias in the +x, -x, +y, and -y positions.

23. The system of claim 22, wherein the control measurement is obtained by scanning adjacent vias in the +2x, -2x, +2y, and -2y positions.

24. A method for characterizing a void in a sample, the method comprising: identifying a first measurement of induced x-ray emissions characteristic of a first material at a first scan target.

identifying a control measurement;

providing the first measurement and the control measurement for comparison to thereby obtain information for characterizing a void associated with the first scan target in the sample.

25. The method of claim 24, wherein the first material has low resistivity.

41. The apparatus of claim 40, wherein the control measurement is obtained by scanning adjacent vias in the $+2x$, $-2x$, $+2y$, and $-2y$ positions.

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